

MAMMOMAT 3000 Modular

SP

Service

Modification Instructions

Installation of the option W/Rh anode/filter
combination

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Purpose

The purpose of this modification is to upgrade a MAMMOMAT 3000 Modular with Mo X-ray tube to Mo/W X-ray tube.

Tools and expendables required

- Standard assembly tools
- Circlip pliers
- Denatured ethanol, 99.5 % pure (may only be denatured with toluene, which does not leave any residues when evaporated) for cleaning the filters or tube window.
- Lint-free cloth or Q-tips (cotton tops) for cleaning
- Lint-free cotton gloves
- Service PC with connecting cable (99 00 440 RE999)

Parts required

Filter-assembly kit, part no. 64 82 967 X041E, comprising the following parts:

Qty	Part
1	Filter assembly
1	Retaining ring
5	Allen screw M5 (countersunk)
4	Cable tie
1	Adapter cable

Documents required

Installation and Start-Up Instructions for MAMMOMAT 3000 Modular.

Time required

Approximately four hours for one person.

Important notes

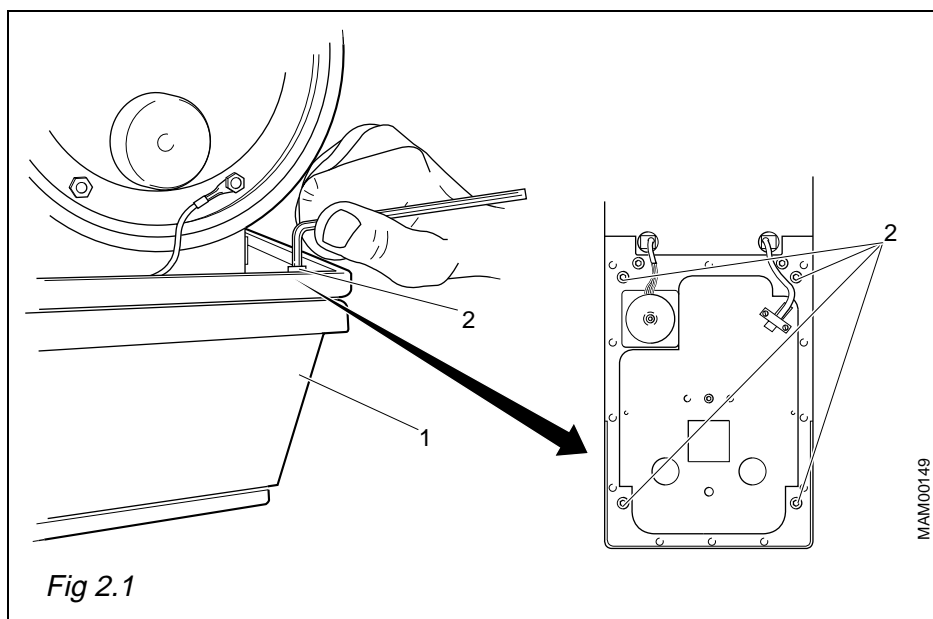
- The Allen screws can be very hard to loosen. When unscrewing, be sure of enough grip with the Allen screwdriver, so that the screws do not get damaged.
- The filters in the filter assembly must not be contaminated in any way. Therefore, always use lint-free cotton gloves during the handling of the filter assembly. Do not remove the filter assembly from its packing until installation.
- If the filters have been contaminated, clean by using the specified alcohol. Other types of solvents may leave residues.

Symbols



Checks and adjustments requiring X-ray to be switched on are marked with the radiation-warning symbol. Protect yourself.

Removal of collimator cover



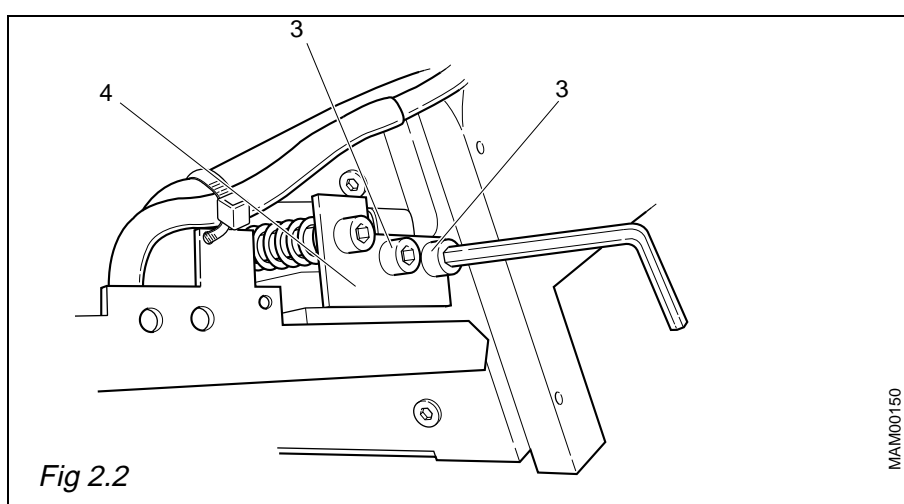
1. Switch off the MAMMOMAT 3000 Modular.
2. Remove the swivel-arm covers.
3. Remove the collimator cover (1) by unscrewing four Allen screws (2).

NOTICE

Do not remove any other Allen screws than shown in figure 2.1.

4. Strap the collimator cover to the stand.

Removal of lamp holder



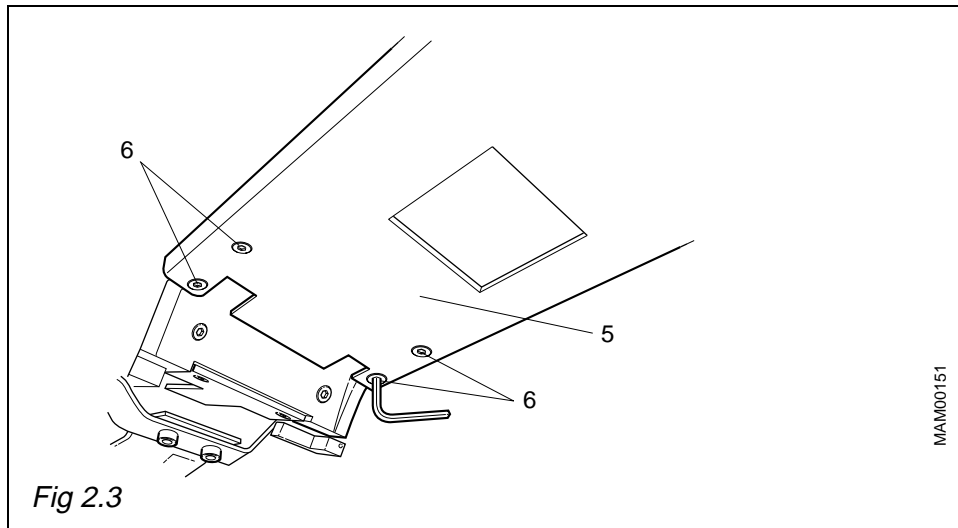
1. Remove the lamp holder (4) by unscrewing the two Allen screws (3).

NOTICE

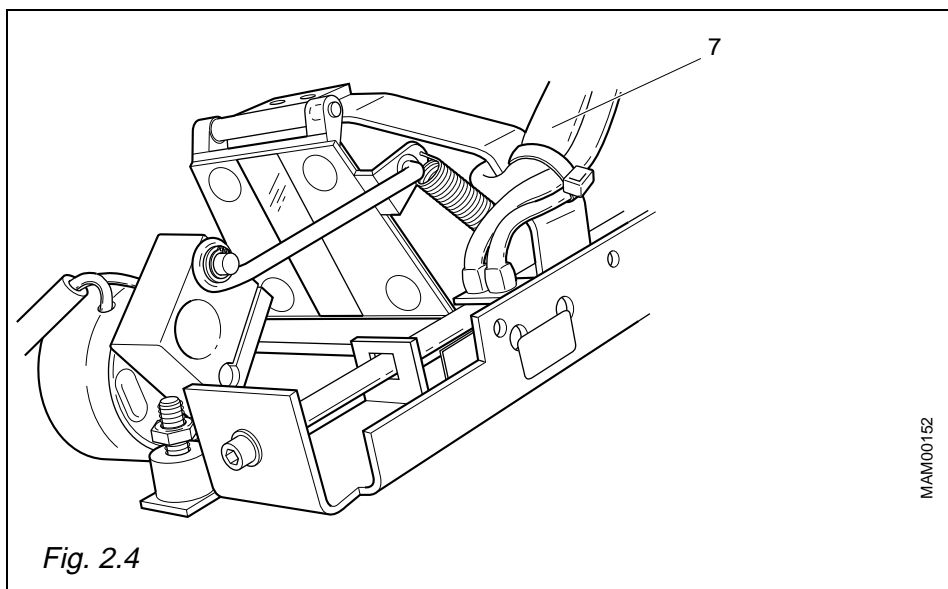
Be careful with the filter assembly.

2. Lift the holder (4) and carefully push it inside the collimator.

Removal of diaphragm-plate assembly

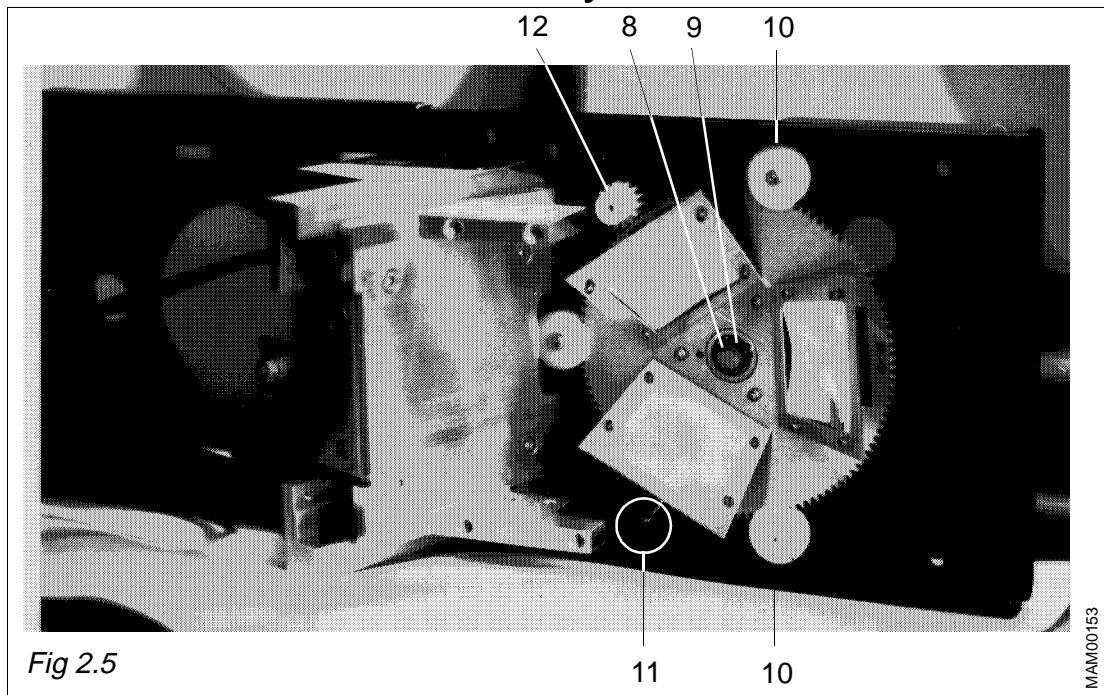


1. Loosen the diaphragm-plate assembly (5) by unscrewing four Allen screws (6).
2. To release the diaphragm-plate assembly, cut the cable ties on each side of the tube head



3. Lower the diaphragm-plate assembly and let it hang in the cables (7).

Removal of old filter assembly



1. Remove retaining ring (8) and bearing (9).
2. Remove the two front guides (10). The rear guide need not be removed.
3. Remove the filter assembly.

NOTICE

Be careful not to damage the optical switch position sensor (11) during the removal.

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Installing the new filter assembly

See figure 2.5 and 3.1.

1. Position the new filter assembly so that the cog disc engages with the motor pinion (12) and the rear guide. The angular position of the filter assembly in relation to the motor pinion is arbitrary.
2. Install the two front guides (10).
3. Install the bearing (9) and secure with the retaining ring (8).

NOTICE

Do not touch the filters with bare fingers. Use lint-free cotton gloves. Be careful not to damage the optical switch position sensor (11) during the installation.

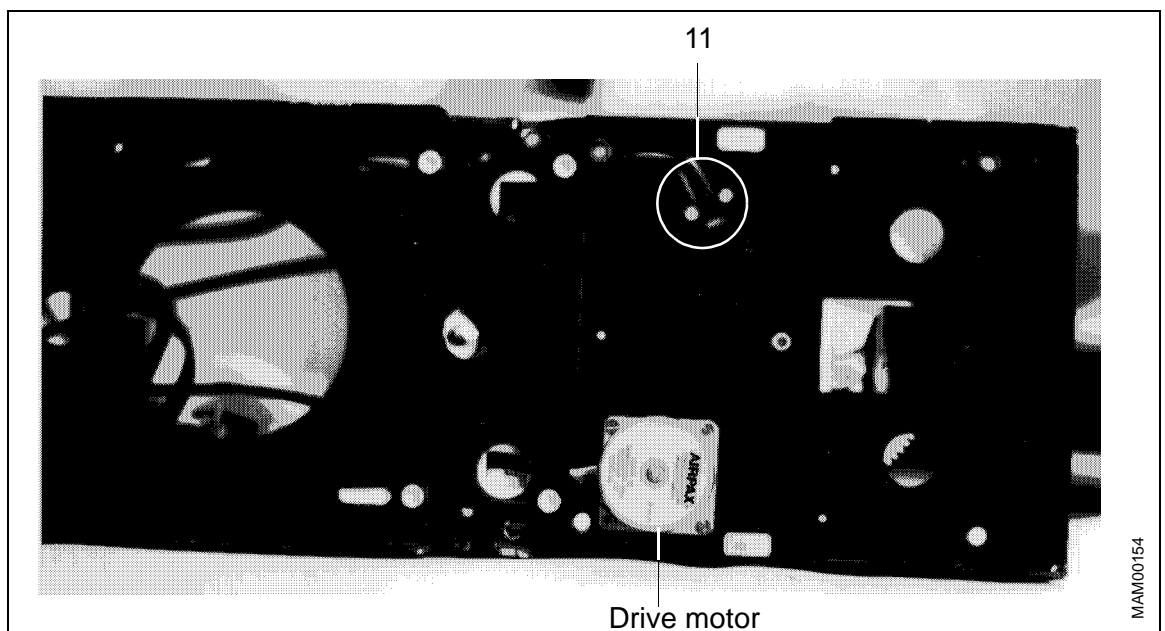


Fig. 3.1 Position sensor and drive motor of the filter assembly

Reinstalling the diaphragm-plate assembly

See figure 2.2 and 2.3.

NOTICE

Be careful with the filter assembly.

1. Fit the diaphragm-plate assembly (5) to the diaphragm-plate holder, while carefully putting the lamp holder into position, and fasten with the four Allen screws (6).
2. Fit the lamp holder (4) to the diaphragm-plate holder and fasten with the two Allen screws (3).
3. Replace the cable ties that were cut during the removal of the diaphragm-plate assembly.

Connecting the service PC

1. Connect a service PC to the MAMMOMAT 3000 Modular.
2. Switch on the MAMMOMAT 3000 Modular.
3. Start the service program.

Configuring and calibrating the tungsten (W) anode

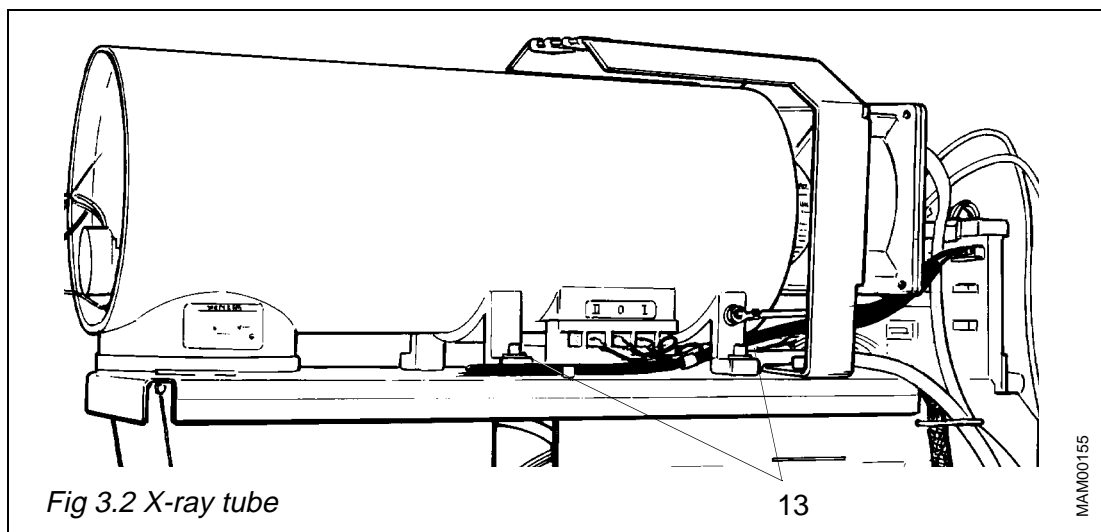
1. In "Main menu", choose "Configuration", then "Anode". Set the value to "Enable" and save with <F2>.
2. In "Main menu" choose "Configuration" and then "Power". Check that large tungsten focus is programmed to 4.7 kW and small tungsten focus is programmed to 0.85 kW. If it is not, change it and save with <F2>.
3. Check the line resistance and reduce the generator power if necessary (see installation instructions, measuring the line resistance).

Checking the rotation movement on the new filter disk

1. Switch on the MAMMOMAT 3000 Modular.
2. Mount the magnification table and select W/Rh on the control panel. Check that there is sufficient space between the cables and the rotating filter assembly.
3. Select different anode/filter combinations on the control panel. During the operation of the filter-assembly motor, check that the filter assembly rotates smoothly without any tendency of jamming. Should this not be the case, this is probably caused by too tight a fit between the cog disc and the motor pinion. This can be adjusted by following the instructions below.

NOTICE

Perform step 4-13 only if the result of the functional check according to point 2 under "Checking the rotation movement on the new filter disk" above is unsatisfactory.

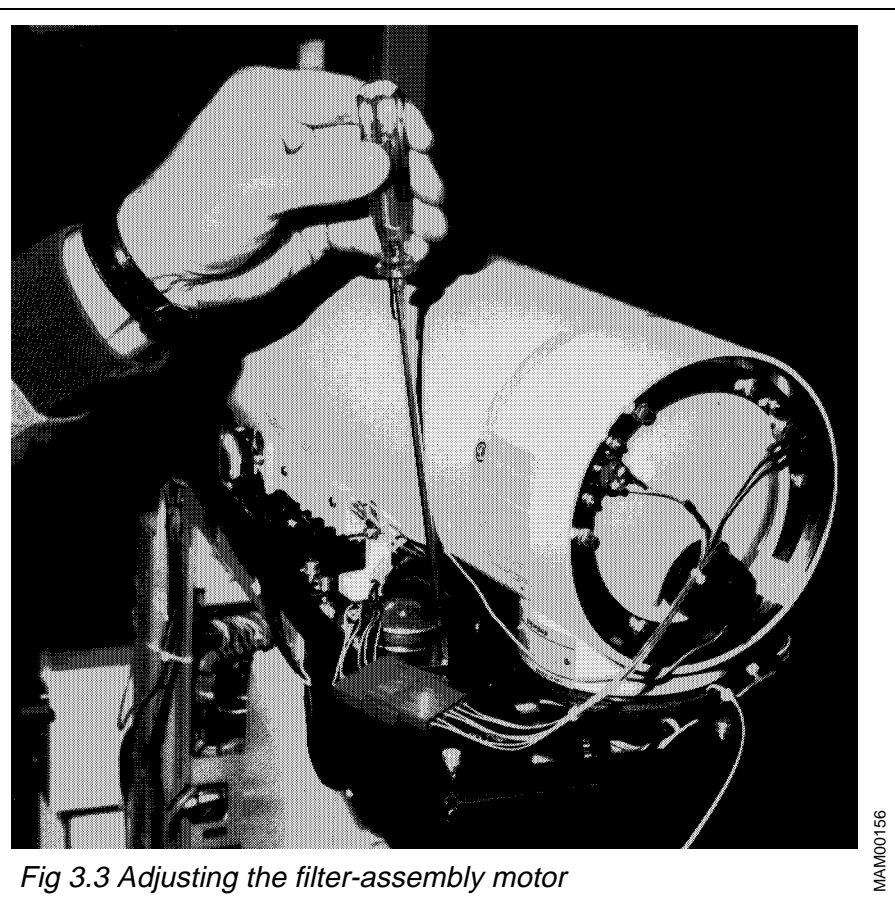


4. Cut the cable ties at the two rear mounting screws for the X-ray tube.
5. Remove the four mounting screws (13) to loosen the X-ray tube (see fig 3.2).
6. Lift the X-ray tube at the front to access the filter-assembly motor.

NOTICE

Do not disconnect any cables.

7. Loosen the screws for the filter-assembly motor, but do not remove them. Adjust the position of the motor so that the filter assembly can rotate freely without jamming (see fig 3.3).
8. Tighten the screws for the motor.
9. Reposition the X-ray tube paying attention to the guiding pin.



10. Tighten the four mounting screws of the X-ray tube.
11. Provide new cable ties at the rear mounting screws of the X-ray tube.
12. System ON.
13. Check the operation of the filter-assembly motor by selecting different anode/filter combinations on the control panel.

Panel programming

1. Reprogram the fourth fixed program according to the procedure described in the operating instructions.
2. The fourth program should have the following parameters (unless the customer has other wishes):
 - 26 kV
 - Iontomat H
 - Film density adjustment 0.0
 - Anode filter combination W/Rh

Adjusting the bias voltage

1. Attach a magnification table (small focus is selected).
2. Select the W/Rh anode/filter combination.
3. Connect digital voltmeter to H3(-) and G(+) at the tube housing filament connections.
4. Adjust R4 on D706 to the voltage stated in the test certificate for the tube (tungsten focus).

NOTICE

Be sure not to expose surrounding people to radiation. Protect yourself.

Adapting the filament heating

In the test certificate for the X-ray tube you can find the filament current values for all focuses.

1. In the service program choose "Main menu" then "Configuration" and then "filament" enter the values for small and large tungsten focus reduced by 200 (e.g. if the test certificate states a filament current of 7000, you shall enter 6800).
2. Save the values with <F2>.

Large focus W/Rh

1. Mount an 18 × 24 table.
2. In the service program choose "Main menu" then "Configuration" and then "Filament".
3. Place the marker on "Large focus tungsten".
4. Press <F3> (learn).
5. The message "Please wait. Adjusting data on control panel" is shown on the screen, then the message "CAUTION!!! Pressing <ALT> + <F6> releases exposure. Protect yourself." is shown.
6. Press <ALT> + <F6> to release exposure.
7. After the exposure the divergence (%) from the correct adaptation value is shown.



8. Press ESC and choose once more "Large focus tungsten" and <F3> (learn). Press <ALT> + <F6> to release exposure.
9. Repeat step 8 until the divergence is within the interval -5% to + 5%.

Small focus W/Rh

1. Mount a magnification table.
2. In the service program choose "Main menu" then "Configuration" and then "Filament".
3. Place the marker on "Small focus tungsten".
4. Repeat the same procedure as described in chapter "Large focus W/Rh" (at point 8. choose "Small focus tungsten").

Adjusting the light field/radiation field

In "Main menu", "Configuration", "Beam limiting device" enter a default value of 17 mm for both small and large tungsten focus. Press <F2> to calibrate and then <F2> to save.

Large tungsten focus

1. Attach an 18 × 24 table.
2. Select W/Rh anode/filter combination.
3. Check the light field/radiation field according to the Installation and Set-up Instructions for MAMMOMAT 3000 Modular.

NOTICE

The beam limiting device must not run into its mechanical endstop. If it does the value must be changed.

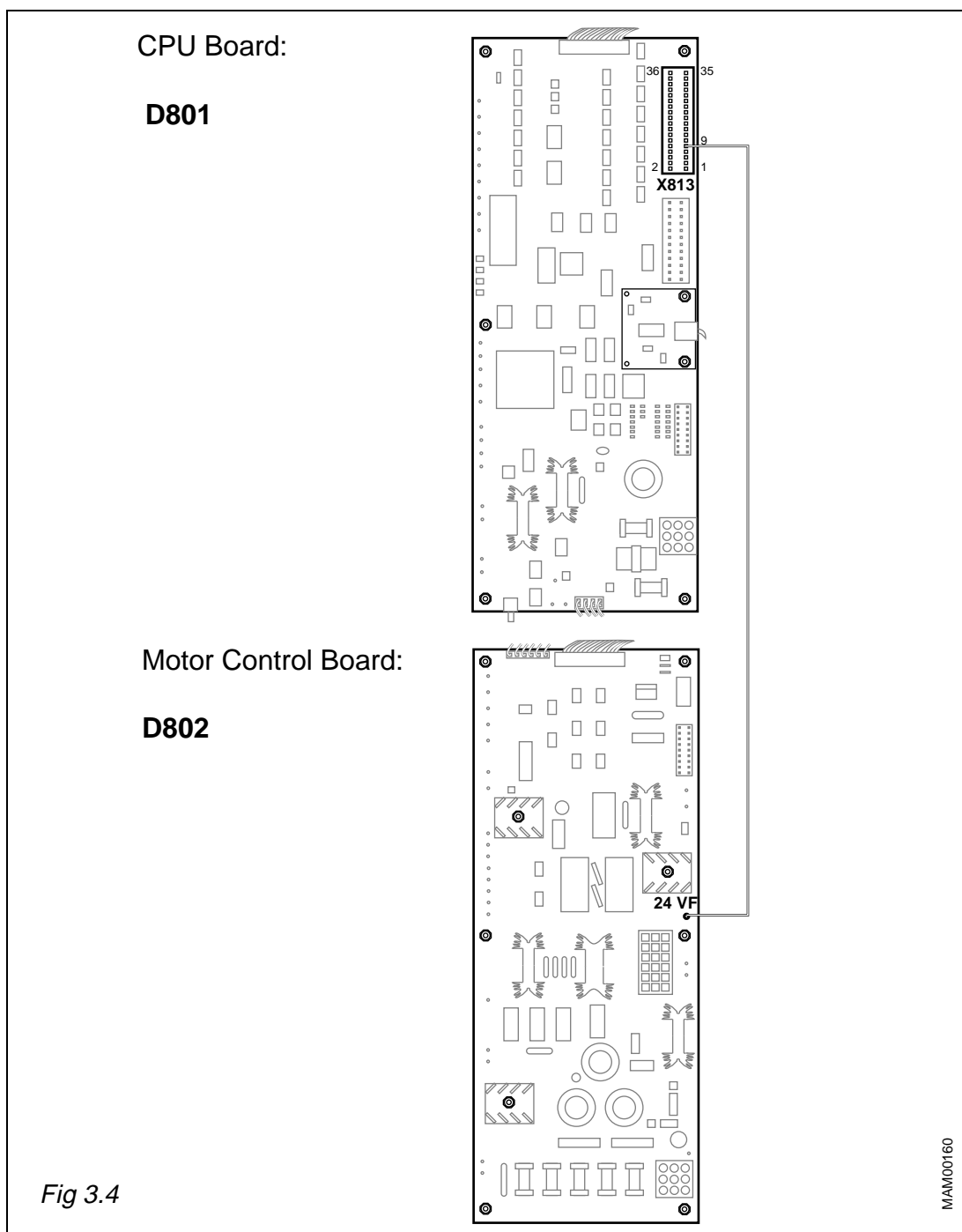
4. If necessary perform adjustments. The adjustment of the over-radiation at the chest wall side is done by increasing/decreasing the value in "Main menu", "Configuration", "Beam limiting device", "Large tungsten, mm from edge". Press <F2> to calibrate and then <F2> to save.

Small tungsten focus

1. Attach an 18 × 24 table.
2. With the MAMMOMAT 3000 Modular switched off, make a connection between X813.9, board side, an D801 and +24 V. This will simulate the magnification table and small focus will be selected.

To do this (see fig 3.4):

- 2.1 Unplug X813 on D801.
- 2.2 Eject pin 9 on connector X813 and isolate the pin.
- 2.3 Insert the pin of the cable supplied in the kit, in location 9 of X813.
- 2.4 Reinsert X813 on D801.
- 2.5 Connect the other end of the supplied cable to MP 24VF on D802.



3. Select W/Rh anode/filter combination.
4. Check the light field/radiation field according to the Installation and Set-up Instructions for MAMMOMAT 3000 Modular.

NOTICE

The beam limiting device must not run into its mechanical endstop. If it does the value must be changed.

5. If necessary perform adjustments. The adjustment of the over-radiation at the chest wall side is done by increasing/decreasing the value in "Main menu", "Configuration", "Beam limiting device", "Small tungsten, mm from edge". Press <F2> to calibrate and then <F2> to save.
6. With the MAMMOMAT 3000 Modular switched off, follow the procedure described in step 2 in the reversed order to remove the adapter cable and restore connector X813 to its original state.

Filter purity verification

The test procedure is dependent on the options available at the site.

For best verification, first use magnification table and then 24 × 30 object table. The magnification table activates the small focus, which will reproduce possible impurities on a larger scale. The 24 × 30 table is used to check the full area of the exposed film. If any of these two options is not available, use only the one available. If none of these two options is available, use the 18 × 24 object table.

For each type of filter, perform the following test:

1. Mount the magnification table.
2. Insert a loaded film cassette in the table.
3. Select the filter to be checked.
4. Select kV and mAs (the exposure setting depends on the film/screen combination used). Make an exposure.
5. Develop the film.
6. Place the film on a film viewing device. The film shall have an even grey exposure. If not, make a new exposure with a different exposure setting.
7. If there are any visible particles or differences in homogeneity, proceed according to "Evaluation of discrepancies on test films" below, until the discrepancy is removed.
8. Repeat steps 2–7 using a 24 cm × 30 cm (or 18 cm × 24 cm) object table.

Evaluation of discrepancies on test films

1.
 - a) Expose a film with a different filter.
 - b) Expose a film with another cassette.
 - c) Expose a film with the cassette placed on top of the table.

NOTICE

Be aware of when performing 1c with magnification table, the magnification factor will be affected. This must be taken into consideration when comparing the test film with the original film.

2. Compare the original film with the test films exposed in 1a–c.
If there are no discrepancies on the film exposed according to 1a, the problem lies in the filter. The previously used filter must then be cleaned with cotton tops and ethanol.

If no discrepancies appear in **1b**, the problem lies in the cassette.

If no discrepancies appear in **1c**, the problem lies in the object table.

3. If discrepancies still appear in the same area, when comparing the original film with the test films from 1a—c, the X-ray tube window must be examined for dirt and, if necessary, be cleaned. Should the discrepancies still remain, the fault is in the X-ray tube.

Final procedure

1. Fit the collimator cover (1) and fasten with the four Allen screws (2) (see fig 2.1). Check that all three anode/filter combinations can be chosen for both large/small focus and 24 × 30 table (if used).
2. System OFF.
3. Reinstall the swivel-arm covers.